KNOWLEDGE TRANSFER AND THE 'ACADEMIC ENTERPRISE' IN THE ALGARVE: CONTRIBUTIONS FROM SOCIAL STUDIES OF SCIENCE AND TECHNOLOGY TO THE UNDERSTANDING OF UNIVERSITY-FIRM RELATIONS

TRANSFERÊNCIA DE CONHECIMENTO E A 'EMPRESA ACADÉMICA' NO ALGARVE: CONTRIBUIÇÕES DOS ESTUDOS SOCIAIS DE CIÊNCIA E TECNOLOGIA PARA A COMPREENSÃO DAS RELAÇÕES UNIVERSIDADE-EMPRESA

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ABSTRACT

University's everyday life is today transformed in an encompassing domain where different types of actors are connected and interrelated. Nevertheless, academic science often feels threatened by the new emerging paradigm characterized by knowledge transfer and the economic exploitation of public research results. This paradigm relates to what can be defined as the 'academic enterprise', the creation of spin-offs, applied research contracts and licensing of industrial property rights of the university. This article explores university-firm relations and tensions, discussing the increased relevance of knowledge transfer. The ideas of Ludwik Fleck, intellectual precursor of Social Studies of Science and Technology, contribute to the understanding of the difficulties of communication between different collectives, their styles of thought and the relevance of 'marginal individuals' in connecting different institutional spheres. Based on a qualitative approach to the case study of the University of Algarve (Portugal) and its attempts to create bridges with the business world, the text illustrates differences between collectives of thought in the 'academic science' and the firm, the recent institutionalization of commercialization of research, and findings for policy-making and management of knowledge transfer activities.

Keywords: Knowledge Transfer, Fleck, Collective of Thought, Marginal Individuals.

RESUMO

A vida quotidiana da Universidade está hoje transformada num domínio abrangente, onde diferentes tipos de atores estão ligados e inter-relacionados. No entanto, a ciência académica sente-se muitas vezes ameaçada pelo novo paradigma emergente caracterizado pela transferência de conhecimento e pela exploração económica dos resultados da investigação pública. Este paradigma relaciona-se com o que pode ser definido como a 'empresa académica', a criação de *spin-offs*, contratos de investigação e licenciamento de direitos de propriedade industrial da universidade. Este artigo explora as relações e as tensões universidade-indústria, discutindo o aumento da relevância da transferência de conhecimento. As ideias de Ludwik Fleck, intelectual precursor dos Estudos Sociais de Ciência e Tecnologia contribuem para a compreensão das dificuldades de comunicação entre os diferentes colectivos, os seus estilos de pensamento e a relevância de 'indivíduos marginais' em conectar diferentes esferas institucionais. Com base numa abordagem qualitativa de estudo de caso da Universidade

do Algarve (Portugal) e das suas tentativas de criar pontes com o mundo da empresa, o texto ilustra as diferenças entre os colectivos de pensamento na ciência académica e na empresa, a recente institucionalização da comercialização da investigação, e contributos para a elaboração de políticas e gestão das actividades de transferência de conhecimento.

Palavras-chave: Transferência de Conhecimento, Fleck, Colectivo de Pensamento, Indivíduos Marginais.

JEL Classification: I23, O30, O31, O32, O39

1. INTRODUCTION

The 'third mission' of the university includes the new mode of knowledge production, the idea of the triple helix and the importance of science in innovation systems, underlining the focus given to organizations and institutions related to innovation. A different logic has emerged where the role of knowledge networks is underlined with various actors interacting in the public and private sectors. Recent decades witnessed the growing difficulty in separating between public good and industrial property. These two spheres were initially distant but are now closer, which has led to the emergence of 'academic enterprise' with new regulatory and normative schemes and cognitive values centred in a systematic effort to strengthen the short-term economic value of research and facilitate commercialization of inventions (Larsen, 2011). The emergence of 'academic enterprise' results largely from dissatisfaction with the direct and measurable benefits of public science. This fact, noted by Pavitt (2001) as the search for greater relevance of public science, was the first justification for the university to seek the firm. The second justification for this new relationship has been the sharp decline in public funding for academic research associated with the increasing costs of research.

These themes, explored in Regional Science, normally benefit from quantitative approaches (Bergman, 2010). It is common for studies on university-industry relations to focus certain metrics and use econometric approaches to ascertain the determinants of this relationship, both from the perspective of firms and public science actors (Larsen, 2011). However, Regional Science would benefit in their understanding of the process of knowledge transfer if it incorporates concepts and approaches from areas such as the Social Studies of Science and Technology (SSST) that have also given attention to these phenomena, yielding important policy implications for science and technology (S&T).

This article seeks to deepen the debate on knowledge transfer and university-firm relations. The text is an example of a qualitative approach, centred on the actors and the specific processes of knowledge transfer that can add valid contributions to the studies that focus primarily on innovation metrics, such as registration and licensing of patents or the number of new spin-offs.

The text is organized into four main sections. The first section discusses the notions of knowledge transfer and its emergence as a central aspect of contemporary change in the role of science. Then, the main ideas of Fleck, the precursor of SSST, are presented emphasizing relevant aspects to the understanding of knowledge transfer. Finally, it presents an empirical study analyzing the specific case of the interaction of the University of Algarve (UAlg) and the regional business fabric, the attempts to understand differences between collectives of thought of researchers and entrepreneurs, and how these groups comprise the

role of university's knowledge transfer office in mediating the relationship between these two institutional spheres.

2. LITERATURE REVIEW OF POLICY STUDIES OF INNOVATION AND KNOWLEDGE TRANSFER

2.1. The New Role of the University and the Importance of Transfer

The intense attention over the last half-century that innovation policies had as a development tool, particularly in developed countries, gave central importance to scientific knowledge for economic progress. Characterizing contemporary societies as being organized around knowledge generated through scientific research and technological development brought to the centre of discussions the importance of knowledge and its impacts, as well as emphasizing notions such as a knowledge society, knowledge economy and risk society (Estanque and Nunes, 2003). The role of universities became more relevant than in the traditional view of innovation where the firm was the main target of attention. Several theories highlighted the new role of knowledge and the university as the Mode 2 of knowledge production (Gibbons *et al.*, 1994), the triple helix (Etzkowitz and Leydesdorff, 1997) or the regional innovation systems (Cooke, 1998) emphasizing that the university is currently characterized by a new mission of its effective participation in territorial dynamics. In this 'third mission', transferring knowledge is assumed to be a central aspect for competitiveness and cohesion of territories, particularly in the explicit and structured interconnections between actors within innovation systems.

The idea of knowledge transfer is distinguished from other similar activities such as the dissemination of technology or the diffusion of innovation. It is based on an active and predominantly formal process of voluntary engagement, between a diversity of actors (research centres, universities, businesses, governments or communities) to the appropriation of new knowledge for mutual benefit in order to improve material, human, and environmental well-being. This broad definition, inspired by Bozeman (2000) and Molas-Gallart *et al.* (2002), is different from others commonly used that limit the transfer of knowledge to a sub-group of activities with financial goals and business benefits.

The formal character of the transfer of knowledge is embedded in protocols, agreements, payments that originate contracts, patents and technology-based companies. Several authors (inter alia, D'Este and Patel, 2007; Debackere and Veugelers, 2005; Bercovitz and Feldman, 2005) identify the formal mechanisms of knowledge transfer: the creation of start-ups and spin-outs, the development and exploitation of industrial property rights, research and development projects, and other channels, such as cooperation in education and training, advanced training to business staff, or student internships. In addition, formal relations are based on personal networks, which increase the likelihood of knowledge exchanges. These informal relationships are difficult to quantify but central to the future formalization of the transfer. Only a minority of university-industry relations are directly connected to commercialization; however, the mobility of human resources, consulting services, collaborative projects and informal contacts have less attention than patent licensing or spinning-out, commonly referred to as the most important channels, because of their potential in attracting additional revenues for the university in times of economic downturn.

2.2. Dilemmas in University-Firm Relations

Several new tensions emerge with the change in the reality of science, which are illustrated by the ongoing debate between the costs and the benefits from knowledge commercialization. There are obvious benefits in terms of profits, incentives and recognition, which can be

directed to other research projects, even of a fundamental nature. The existence of patents and applied R&D projects may lead, for example, to new products and processes that improve the range of availabilities for individuals and firms, enhancing consumer society and improving productivity. But there are less positive aspects, considered by Bok (2003) among others, as costs, often speculative and intangible, that result in breaches of academic standards. For example, a project with little scientific value, which is developed only because it results in the entry of financial resources for the university, damages the academic community with tensions and divisions where few existed before. Professors who work hard in their academic activities may be disregarding extraordinary incomes achieved by colleagues in consulting or spinning-out. Disputes for intellectual property rights (IPR) may emerge. Scholars may accuse the coordinators of their centres of stealing ideas to benefit a company in which they have economic interests. The increase in cash flows may increase competition for private interests, which damages the academia, because it supposedly works better in a comfortable climate of trust and sharing. Risks to the reputation of the university and to the integrity of academic interests emerge. The university was for a long time considered the main source of disinterested knowledge. If this lack of interest is diluted, due to an objective and measurable interest in monetary units, informed opinion begins to blur, a function that universities could formerly ensure. A corollary of this type of criticism is that the public may lose confidence in the objectivity of researchers because they are limited by their own private interests and by what university customers prefer to be told.

The emergence of a patenting culture as a way of marketing knowledge also created limits for scientific credibility (Packer and Webster, 1996). The conversion of academic science to patenting raises new questions for researchers in the recognition of their knowledge networks, as they are increasingly moving between different social worlds to be rewarded for their academic achievements and patenting results. There are important limits to the behaviour of the scientist, in particular, when we recall the Mertonian ethos with the principles of universalism, communalism, disinterestedness and organized scepticism, which guaranteed the 'good science'. The vision of Nelson (2004) and Santos (2008) underlines the dangers of patenting, a process that has been particularly intense in the last decade in the scientific areas with the greatest economic potential, such as biotechnology; this has changed relationships within the academy, often blocking free discussion and open results, jeopardizing the production of new knowledge and distorting the research agenda setting.

Shapin (2008) enters this discussion with another perspective. In the twentieth century, the world of science was transformed into an interesting job market, and in some areas, the ability of an individual to ascend to high levels of wealth through science has become a reality. Thus, there is a great moral heterogeneity, and there is room to think that there is more than only one location, the university, where the good scientific life can be found. The business environment can also be adequate for freethinking leading to the generation of scientific knowledge transferable to the market. The new 'scientist-entrepreneur' intends to evolve rapidly and have access to the more interesting decisions and wage levels compatible with individual capabilities, something that is contradicted by the public, science logic where time and hierarchy are central determinants in personal valorisation. Funders of public research proposals are commonly conservative, in line with the objectives of disciplinary mainstreams. The excessive competition for financial support and the stressful routine of 'publish or perish' are usually referred to as disadvantages of the university, compared to the actual situation of the firm in which the freedom to R&D is greater. Steven Shapin presents examples of how current ideas based on scientific knowledge achieve business potential. Platforms such as those obtained by knowledge transfer offices (KTOs) in universities are essential to the process of maturing, supporting and developing ideas that structure contact among entrepreneurs, investors, business partners, and between different groups, linking

scientific knowledge to its market potential and sharing aspirations and virtues. The world of science in late modernity, using the expression of Shapin, is complex and composed of actors from different spheres, scientists, engineers, managers of major companies, business angels, venture capitalists, industrial property agents, technology transfer managers, heads of universities and research centre members.

Several types of organizations have emerged in the boundary areas, where institutional spheres of academia and firm overlap, functioning as intermediary structures: technology centres, laboratories and certification testing, technology parks, science parks, services to support research and innovation, technology platforms, patent centres, and business incubators. KTOs in universities are an example of this type of entity that tries to suppress communication gaps to approach the market and technology expertise with business demand. Guston (1999) showed how these organisms are boundary organizations that characterize the view advocated by the principal-agent theory. A boundary organization runs a stabilization mechanism that internalizes the contingent nature of science in their everyday practice, creating boundary objects for cooperation between principals and agents. These offices are organizations that provide common ground, legitimizing the creation and use of boundary objects, such as patents, and originating the participation of key actors where they appear as expert mediators. Siegel *et al.* (2003) summarize the main stakeholders and their organizational cultures in knowledge transfer overlapping areas:

- Scientists with an academic organizational culture attempt to produce new scientific knowledge, motivated by peer recognition, for additional financial gains and funding for research;
- The companies/entrepreneurs with an entrepreneurial organizational culture expect to commercialize new technology, benefit financially, and maintain ownership of knowledge and technology;
- The knowledge transfer offices, which have a bureaucratic organizational culture, work with universities and industry to structure cooperation, protect and commercialize intellectual property of the university, facilitate communication, ensure technological diffusion, and secure additional funding for research.

3. CONTRIBUTIONS FROM SSST TO KNOWLEDGE TRANSFER

3.1. The Interest in Ludwik Fleck within SSST

Since its almost random discovery, the monograph "Entsehung und Entwicklung einer wissenschaftelichen Tatsache", translated as "Genesis and Development of a Scientific Fact" and written in 1935, has been the subject of much academic interest. Robert Merton, the great instigator of this translation, found in Ludwik Fleck clues about his personal interest in the influence of the social structure in the production of scientific knowledge. Fleck wrote texts that were largely ignored. In 1935, he wrote an essay about scientific observation and perception in which introduced the idea of style of thought; he then extended the discussion of collectives of thought with his 1936 essay "On the Crisis of 'Reality'". However, most of his ideas are well presented in the monograph. In 1960, Fleck wrote "Crisis in Science" that is considered his last writing and was rejected by the journal Science.

Fleck remained forgotten until the seventies of the twentieth century when his work was translated into English reaching a much wider audience than the German edition allowed. Fleck (1896-1961) devoted himself to medicine and bacteriology, and he became interested in science as a subject of research in the interdisciplinary environment at the University of Lwów, then part of Poland and now Ukraine, where he participated in various scientific circles. Fleck, a Polish Jew imprisoned during World War II in concentration camps, was

obliged to create vaccines for Nazi forces, which allegedly were tested on other prisoners. This mysterious character of Fleck's biography has boosted interest in not only exploring his theoretical contributions but also his life.

Despite the late discovery, the influence and impact of Fleck in SSST have been enormous. Fleck is currently presented as a thinker ahead of his time, a forerunner of the constructivist approach that blended practical knowledge with academic reflection. Kuhn was one of the first to recognize the importance of Fleck. In the preface to the first edition of the book "The Structure of Scientific Revolutions" in 1962, he wrote *"[through] random exploration [...] I have encountered almost unknown Fleck's monograph [...] an essay that anticipates many of my own ideas."* In the prologue to the English translation of this monograph, Kuhn explains his story with Fleck and how a footnote in another book aroused the interest of reading a book with a title so suggestive for his own research interests. Kuhn was particularly stimulated by the difficulties of transmission of ideas between collectives and the possibilities and limitations of participation in different communities. Theories of collectives and styles of thought made crucial contributions to an understanding of how society restricts the genesis and development of a scientific fact. Many comparisons have been made between Fleck and Kuhn. The fundamental difference between these authors is that Kuhn focuses on the foundations of the science system of ideas and the theoretical framework that governs the scientific community. The paradigm defines a regular and stable structure in order to crystallize a determined theoretical structure governed by fixed principles in periods of normal science. New results can only cause a revolution when there is a disturbance in the established order. For Fleck, science is associated with knowledge and practical experience. A style of thought is alive, adapts and evolves to constant change.

With great importance in the School of Edinburgh, Fleck currently attracts increasing interest from researchers who focus their work in laboratory and discursive practices (Lowy, 1994). The reception of Fleck and his influence on SSST, as underlined by Nunes (2008), ranges from the epistemographic readings of Dear and praxiographic readings of Mol, social studies of biomedicine, and the issue of coexistence and articulation of incommensurable styles and collectives to "thinking with eyes and hands" (Latour, 1988), the inscriptions and the materiality of science (Latour and Woolgar, 1979), the biomedical platforms, the enactment of biomedical entities and their ontologies, boundary concepts and objects (Star, 1989), and the elaboration of the concept of style in philosophy and history of science and the question of the disunity of science (Galison and Stump, 1996).

For example, Bruno Latour, one of the instigators of Actor-Network-Theory (ANT), presents Fleck as the founder of the sociology of science (Latour, 2005). The conceptual framework proposed by Actor-Network-Theory, which benefits from the ideas of Fleck, appears to understand other dimensions of knowledge transfer. Several authors think that ANT is an appropriate approach to analyze 'black-boxing' in the innovation process (eg, McMaster, Vidgen and Wastell, 1997; Oliveira, 2008; Pinto *et al.*, 2011). The idea of transfer easily connects with the central notion of ANT, translation, which is the process in which actors constantly engage to transfer their languages, problems, identities and interests to others. *"Translating is transferring"*: transferring interests, purposes, devices, applications. The transfer allows the consideration of a set of practices that produce change (Corcuff, 2001). The notion of network points to stabilization among different types of actors, individuals, groups or objects in ANT. Translation is the central mechanism that creates the actor-network, which defines the group's network of relationships and where the actor and the network are mutually constitutive. This is a central process in the construction and deconstruction of reality. Latour proposes that actors are followed in the process of translation, achieved through different activities, competing strategies, trials of strength, mobilization and recruitment, preparation of commitment devices and obligatory passage

points to consolidate alliances and bring out spokespersons. The network is the result of a relatively stable balance of power in the translation process. Actors, people, and objects are not fixed and only achieve meaning through relationships with other actors. It is the network that allows players to increase power and influence. At the beginning of translation the worlds of the university and the firm are separate without communication; in the end there is a discourse about shared objectives and common activities (Colyvas and Powell, 2006; Berman, 2008).

The comparative epistemology of Fleck offers a unique set of tools to look at the production and circulation of knowledge in contemporary societies, allowing the construction of a geography of intellectual fields, describing not only the people and places but also the change happening (Rochel of Camargo, 2002). The approach to science and Fleck's philosophical concepts are rooted in practical experience as a medical bacteriologist. The interest in Fleck also lies in its ability to study various types of communities and their interactions with knowledge. The fact that Fleck comes from the Health sector makes it particularly attractive for application in this field of science, in particular the use of the concepts of style of thought, in order to understand the community, its connection to practice and instruments used. By underlining the differences between styles of different groups, his ideas reveal the centrality of 'marginal individuals' and may contribute to an explanation of relevant processes of knowledge transfer between universities and firms.

3.2. Main Contributions from Fleck's Monograph

In his monograph, Fleck describes the evolution of the concept of syphilis, stressing that science must be seen as a historically bounded activity by the existence of different collectives. Fleck shows how a disease can be seen as a social construction and how physicians find it impossible to describe an infection, an event of great complexity involving the interaction of at least two complex systems, parasite and host, by a simple causality. This type of causality is only meaningful when framed by a common style of thought. The style of thought not only determines how the object is observed but highlights certain elements while neglecting others. The scientific facts have a genesis and development and are the result of scientific activity in the context of specific thinking frameworks. The relevance of social and cultural dynamics originates the need for a comparative historical epistemology. The present and past knowledge is the starting point for the genesis and development of new knowledge. The distinction between truth and error can only make sense in the context of styles of thought and certain collective thinking. There are continuities between common sense, scientific thinking and their languages that cannot be neglected, such as the heuristic nature of proto-ideas. The study of science should be understood in a relativistic way taking into account social and axiological assumptions.

The construction of knowledge should not only be considered a bilateral relationship; rather, the subject should also still consider the state of latent knowledge in the collective as a way to connect object and subject. A quote from the Descriptive Analysis of the English translation of Fleck's monograph, a summary of an unpublished work in 1961 "Towards a Free and More Human Science", refers that *"[b]etween the subject and the object there exists a third thing, the community. It is creative like the subject, refractory like the object, and dangerous like an elemental power."* Cognition is thus a function of these three components: the subject, the object and the collective thinking in which the subject acts.

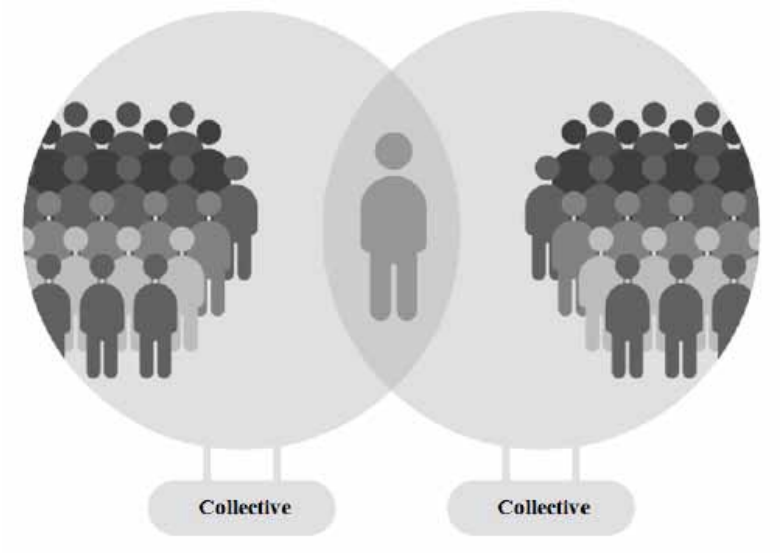
Fleck (1935|1986a) states that each style of thought characterizes a certain collective. The style of thought is a collective function that fits the historical development of a field of thought and leads to a specific stock of knowledge and cultural characteristics. The style of a group is the result of the theoretical and practical education of a particular individual, the transfers between teachers and students, and the relationships with the community.

Importantly, it is not an optional process but rather an imposition that happens during the process of socialization (Rochel de Camargo, 2002). Individuals with the same references belong to the same collective of thought. Fleck interconnects the relationship between observation, theory and construction of scientific fact. The scientific fact is understood within the style of thought, linked to the concepts of observation and experience, giving diversity to collectives of thought. Fleck argues that there is a connection between styles and relevant concepts existing at a particular time, so there is a constraint on the historical development of thought. The different styles of thought can coexist but are restrictions to the understanding of each new scientific discovery. Fleck (1936|1986b) notes that the technical terms of a collective of thought not only express the meaning assigned to them by the members but also assume a symbolic, almost "sacred" connotation for practitioners, unreachable for the uninitiated, that transmits a specific power. A collective of thought can thus be understood as a community of people exchanging ideas and maintaining an intellectual interaction within the same style of thought. In each collective there is an esoteric circle, experts who produce knowledge, and an exoteric circle, educated amateurs, where Fleck sometimes includes the general public. There is tension between the two circles, as members of the esoteric circle tend to repel non-members (Rochel de Camargo, 2002). However, advances in science are often a result of contacts between the circles. Acceptance into the group occurs after a learning period in which power and authority play a relevant role. In this process, the increased ability to recognize certain phenomena accompanies a reduction in the ability to recognize and use certain other, technical capabilities (Lowy, 1994).

There is a limited ability to communicate between groups, but there are some styles that are closer to each other than others, which facilitate communication between collectives, e.g., between physicians and biologists or between economists and managers. Therefore, varieties of styles and varieties of collectives exist that vary in degrees of closeness with each other. A particular style of thought determines the perception and creation of tools and techniques, as well as the interpretation of results. The determination of the phenomena incorporating a common classification depends on the beliefs and practices in each historic period. Communication between collectives depends on the circulation of facts and concepts. The facts do not exist, per se; they only make sense as they adapt to style. Events produced by a particular group are assimilated by other collectives through translation processes to their own styles. Translation is always damaging, modifying facts and ignoring and emphasizing certain aspects in order to adapt to the style of the receiver. The relationship between collectives is carried out by 'marginal individuals' who belong to more than one collective and move at the intersections between different groups, favouring the creation of new ways of thinking, and increasing the generation of proto-ideas, the genesis of inventions (Figure 1).

Many scientific facts are born from these initial ideas. This complex process of interaction between collectives leads to deterioration of the systems view; the change in styles of thought opens up new possibilities for the creation of new facts. In Fleck's framework, there are two phases in the development of the ideas: the first, classicism, in which all the facts agree and adapt to the existing theory, and the second, reinterpretation, where theory becomes increasingly inappropriate and facts lack reinterpretation in light of new theories. In this process, there are two types of observation: the confused observation, an inaccurate look at the phenomenon, and the formative and direct observation, requiring scientific training and constituting the basis of styles of thought.

Figure 1. The 'Marginal Individual' between collectives of thought



Source: Pinto (2012)

This short insight into the ideas through which Ludwik Fleck emphasized the importance of combining theory and practice reveal the fallacies that occur when these elements in science are lacking (Pfuetzenreiter, 2003). The *"mythology"* of Fleck was challenged by Hedfors (2008, 2007, 2006) and answered by Amsterdamka *et al.* (2008). The subject of the debate was that this first author indicated that there was no reason for so much attention to the ideas of Fleck. The argument is based on the assumption that their epistemological ideas were not ignored but rejected by their peers. The aim of Fleck's arguments was, according to Eva Hedfors, to legitimize his questionable scientific practices. The author also raised questions about the ethical dimension of Fleck's research, suggesting that he was involved in different criminal experiments during his imprisonment in Nazi concentration camps in World War II. Despite this controversy, Fleck is an author of great importance; he is a pioneer in the way he formulated debates with depth that remain central to SSST, implicitly arguing that scientific knowledge is a result of a collective process of construction, reproduction, socialization and learning.

4. SYNTHETIC PRESENTATION OF THE CASE STUDY: KNOWLEDGE TRANSFER IN THE ALGARVE

The Algarve is certainly not known nationally and internationally for its innovative capacity or its scientific and technological profile (Pinto, 2009). It is a tourism destination that has benefited much in terms of economic development from its particularly productive specialization transforming from a region considered poor on the European scene to one of the most developed in national standards (Guerreiro, 2008). For the European structural funds allocation in the period of 2007-2013, the region abandoned the group of convergence regions; and, for 2014-2020, it will maintain this status, now designated as a 'region in transition'.

The concentration of resources and investments in tourism caused some lack of attention to other activities; but, from the standpoint of strategy, regional actors have tried to engage in efforts to diversify the regional economy (Barreira, 2009). Note, for example, the attention given by the Regional Strategy 2007-13 (CCDR Algarve, 2006) or the Regional Innovation

Plan (UAlg, 2007a), where it is assumed that the challenge is to transform the Algarve into a knowledge-based region. This path is not easy because several obstacles need to be overcome for the consolidation of regional innovation dynamics (Pinto and Guerreiro, 2010).

In this vision of a more innovative region, the University of Algarve is a central actor (Pinto *et al.*, 2012). UAlg is the only public higher education institution in the region. Despite its short existence, created in 1979, the University has an interesting regional dynamic in assuming a role not only as a centre of qualification of human capital but also as the most important research institution in this region. An evaluation of UAlg performance in R&D and cooperation in services between 2000 and 2006 (Cruz, 2006) highlighted that the expertise is concentrated in the fields of natural sciences, particularly in marine sciences, an area in which the University presents a significant critical mass in terms of the existence of excellence centres, training of human resources and market linkages. The merit in this field was one of the main drivers for UAlg demonstrating a good capacity of knowledge production measured by international scientific publications (Sousa Lobo, 2005). In parallel, the coexistence in the same institution of the university and polytechnic subsystems have also been identified as important for the strong relationship with the region itself (UAlg, 2007b). This regional "monopoly" assured to UAlg a relationship with the firms that tried to invest in knowledge and innovation in recent years.

Since 2003, the UAlg has structured a knowledge transfer office, the Regional Centre for Innovation of the Algarve (CRIA). It was a device for participating in various networks underpinning the national level, e.g., the offices for industrial property promotion (GAPI) and the technology transfer and knowledge offices (OTIC), with the aim of consolidating relations between the university and industry, while supporting and promoting the use of mechanisms for protecting intellectual property. The intervention of this office was recognized by relevant regional and national partners, with their participation in several networks and the preparation of strategic studies on the topic of innovation. The low density of innovation actors in this region gave this KTO excessive relevance, broader than in comparable cases of academic intermediation bodies (Pinto, 2012). It has assumed a central role in the connectivity of the entire innovation system (CCDR, 2006). At the European level, the relevance of this office was also recognized with awards from the European Commission and ERIK Network, both in 2007, and the participation in multiple projects in European cooperation programs in areas related to innovation and knowledge transfer.

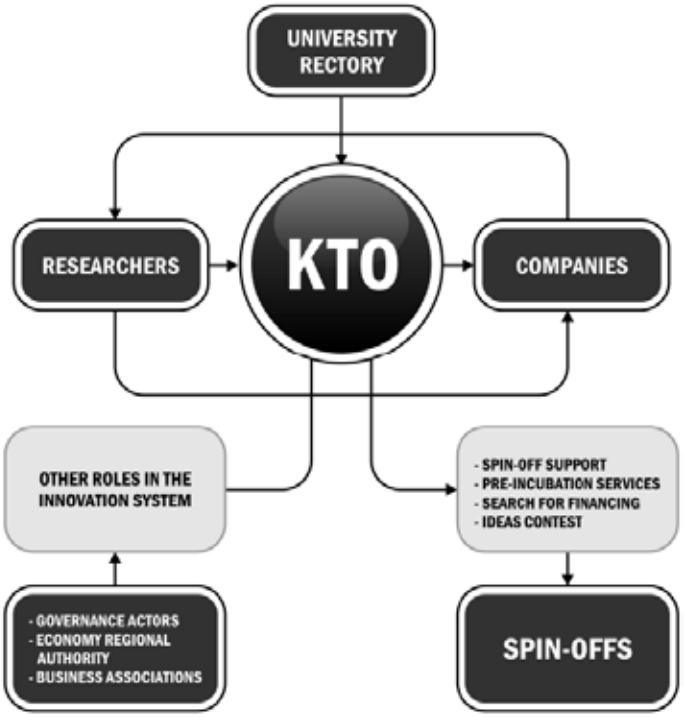
The dependence on structuring partnerships in the context of INTERREG 2007-13 programmes was a distinguishing factor from other national offices, including even the leadership of a project focused on knowledge transfer in the maritime clusters. In January 2010, with the changes introduced by the creation of new Statutes of the University of Algarve (approved by *Despacho Normativo n.º 65/2008, 11 de Dezembro*, published in *Diário da República, 2.ª série, n.º 246, 22 de Dezembro de 2008*) to respond to the new legal framework of higher education institutions, UAlg absorbed the KTO into its functional structure. CRIA was then established as a formal division of the University, the Division of Entrepreneurship and Technology Transfer, inside the UAIC - Support Unit of the Scientific Research and Postgraduate Training (Regulation n.º 57/2010).

The analysis of the knowledge transfer activities for linking the university to the firm, presented in detail in Pinto (2012), facilitate the understanding of the four main channels used by this KTO:

i. the implementation of initiatives to increase the levels of entrepreneurship inside the academia;
ii. direct support to business consolidation based on scientific knowledge;
iii. the support for the establishment of partnerships with firms seeking university; and
iv. the support to researchers seeking solutions to transfer R&D results to firms.

The focus of the KTO connects with academic entrepreneurship, where the office has collected relevant expertise particularly linked to the sciences and technologies of the Sea, creating a diversity of 'boundary objects'. These artefacts reside across borders of different 'social worlds', allowing a more effective communication among groups with differing perspectives (Star, 1989) as the support to spin-offs, the creation of pre-incubation services, seeking funding and competition of ideas. The office, hierarchically dependent on the Rectory, seeks to connect university research with companies; however, the reverse also occurs, as companies try to meet the demand for knowledge from regional firms, assuming a role of connection in the regional innovation system, in particular for the creation of advanced enterprises. Figure 2 outlines the workflows, the role of the actor in the innovation system, and the relative attention to certain activities. The comparison between this and other innovation intermediation actors can be found in Pinto (2012).

Figure 2. The organization of knowledge transfer in the KTO



Source: Pinto (2012)

5. TENSION IN UNIVERSITY-FIRM RELATIONS: PERCEPTIONS FROM BOUNDARY AREAS

5.1. Methodological Notes

The literature review allows, at this point, the emphasis of two central aspects: i) the transfer of knowledge between universities and companies is a central process in the dynamics of innovation, and ii) the contact between collectives is made more effective by 'marginal individuals', which facilitates the translation process.

The innovative profile of the Algarve, synthetically presented in the previous section, showed contrasts between the collectives of thought of the thirty-year-old university and the regional firms based on tourism-related activities and often characterized by the low intensity of scientific knowledge and limited value added. Thus, this case can be considered a 'strategic research site' (Merton, 1987). The 'strategic research materials' are places,

objects, or events which present the phenomena to be explained or interpreted with such an advantage and in an affordable way that allows the research to understand problems previously inaccessible. It is assumed that the characteristics of the regional structure of the Algarve provide clear evidence of the tensions between academia and enterprise. This section frames a more applied empirical study, seeking to understand the problems that emanate directly from reality and proposing concrete action (Fernández-Esquinas, 2006). The empirical study seeks to highlight the importance of approaches grounded in SSST to understand the transfer of knowledge. The analysis discusses two critical issues. The first is whether the differences between entrepreneurs and researchers shape different collectives of thought in Fleck's perspective. The second question refers to the findings of the importance of 'marginal individuals'. For this, the section presents the vision of these groups about the knowledge transfer offices. To analyze these issues there were different moments for gathering information, based on formal attempts of the University of Algarve, to create a stable platform between both groups to increase the effectiveness of transfer.

The first moment of data collection was through participant observation in Faro in June 2007 at a workshop on financing opportunities for small and medium enterprises in R&D, which sought the creation of consortium research projects. This event brought together about one hundred and twenty people, of whom about two-thirds came from the business world. The speakers and entrepreneurs reported their experience. They were very argumentative of the reality of European projects in consortium. Firstly, this was because projects were not based on strong relationships of trust and sharing, which affected the implemented activities. Secondly, it was because the large time for approval, payments and implementation of activities was not adapted to business reality. The approval of the project took so long that there were often cases of approvals which no longer held interest to the current activities of the company. They also criticized the relatively minor presence of the academic research participants in the event, as they seemed less concerned about collaborations of this kind. The information collected was complemented with interviews of eight participating companies seeking to understand their main objectives, the scientific capacity and topics of interest, the R&D work, previous cooperation with the University, benefits and results they expected to achieve.

In December 2007, the University organized the INOVA 2007 - Exhibition and Conference on Innovation and Technology Transfer in the Algarve. This event tried to address issues related to creating a more favourable environment for innovation. On the first day a number of transversal issues to the theme of innovation were discussed, such as the consolidation of a regional innovation system in the Algarve. On the second day the catalogue of skills and services of laboratories and R&D centres of the University was presented, a tool that tried to expose the research potential, favouring the transfer of knowledge. A number of university-company meetings were held during the event, where the main objective was to create bridges between these two worlds facilitating the promotion of collaborative R&D. Parallel sessions were related to key-areas: agro-food technologies and tourism, alternative energy, sea and golf. These meetings between researchers, entrepreneurs, and elements of regional institutions had about one hundred and thirty participants. The result of this initiative was a group of ideas, which were developed and later gave rise to projects submitted for funding opportunities, in particular in the framework of the Regional Operational Programme Algarve 21. Under each topic there was a University staff member that framed the research work in the area followed by a participant from the business world who presented a particular view. The special session of agro-food technologies was the second moment of collecting information through observation. The second event involved a moment of an extended exchange of ideas and multilateral meetings, which sought to strengthen personal contacts

and informal knowledge creation to facilitate an understanding of the convergent interests of the participants.

Finally, one final moment for data collection was a work session on the connection between the university and companies in the region, inserted in the meetings of the Institute for Competitiveness Support to Small and Medium Enterprises and Innovation (IAPMEI), held in Faro in December 2009. This event brought together twenty-seven participants, nineteen companies and even more facilitators (researchers and technicians from the University, as well as representatives of relevant agencies in the region). The organizers prepared a report with the main results (IAPMEI, 2009). There were three working groups, one of which focused explicitly on "Strategies for Leveraging Technology and Knowledge Transfer for Companies". A focus group methodology was employed with two moderators, one of whom was the author, essentially looking to confirm the problems of the university-firm identified above, highlighting critical factors of these problems and making proposals to overcome them. The results were eminently confirmatory of previous collection moments.

5.2. Dimensions of Tension between Collectives of Thought

The analysis shows the misaligned positions and allows the highlighting of central topics to the relationship of the business world and academia. Based on the notes taken at these meetings, it was possible to systematize the positions on some issues for both groups. The empirical analysis carried out allows the emphasizing of four main dimensions of tension between entrepreneurs and researchers with contrasting styles of thought.

5.2.1. University-Firm Relations

There is a general mistrust between the two collectives. Entrepreneurs think that researchers approach companies only when they do not have resources to fund their research. In the current economic context, the constantly repeated statement is that the approach of the universities to the business world is due only to the precarious financial situation of public scientific research in Portugal, in particular with universities, something that seems to be a small part of what actually occurs. On the contrary, however, researchers find that when their research arouses interest in business, it is because its value is clearly superior to what the company is offering to pay to fund R&D. Often, speculatively, their activities become more expensive, leading to shrinkage of the initial private interest.

It was noted that the university often promotes research that the firms or market do not demand. There is a gap between what researchers want to investigate and what companies actually need. According to the general opinion of the participants in the focus group, this gap between what is sought by companies and the provision of advanced services was usually related to a lower sophistication of companies, which originated the lack of interest by the university in conducting research to the business fabric. On the other hand, many researchers believe that focusing research on the needs of companies does not allow them to engage in scientific production of an excellence level required on international terms, the main criteria of their current assessment exercises. Universities also have few channels to detect what firms need. An improvement of enterprises' capacities can come through collaborative projects with the university, in particular applied research that may favour the creation and definition of strategic innovation. The university should strengthen itself organizationally for a professionalized and consistent approach to knowledge transfer.

However, both groups consider it important to boost university-firm relations, as there are very positive aspects that can result from this. Companies referred mainly to their ability to access the expertise, infrastructure and equipment to which they would otherwise not have access. This allows them to participate in interesting projects for their productive activity, enabling them to have an image in the market of innovation and differentiating them from

their competitors, obtaining competitive advantages. The aspect most highlighted by the researchers was that collaboration with companies helps to approach the empirical reality, giving them a greater capacity to understand basic science, discovering clues and directions for research, and enabling the entry of additional financial resources which can be directed towards new research.

Even with the accumulated knowledge and the geographical proximity of the university with companies, a limited threshold of protocols and partnerships between research units and companies continues to exist. The criticisms from researchers and entrepreneurs supported by intermediary organizations, such as KTOs, are weaker. Usually, those who obtain support from these entities are members of overlapping areas from each of the groups, with interest in working together. This frequently occurs in repeated cooperation, and these experiences can gradually generate trust and social capital throughout the collectives of the organizations. Both researchers and firms showed appreciation of the existence of an intermediate body. Value is placed on the emergence of a new actor focused not on specific objectives for any of the collectives but on targets linked with the success of the interconnection between the two groups.

5.2.2. The Role of Science

There are doubts about the relationship between the 'academic science' and the activities of the 'academic enterprise'. Starting with the academic world, there is no consensus about the definition and role of science in society. Professors have difficulty realizing what is required from them in adapting education, particularly the first cycle of Bologna, with the basic research activities that they must perform. Professors, when involved in projects, are often burdened with administrative and financial issues that affect time availability, eliminating the possibility of knowledge being applied in tasks that were more important. The university is fractured. On the one hand, some argue that the importance of research and 'academic science' is the main mission of the university and the basis and reference for all the knowledge either applied or not applied. On the other hand, many argue that science has to approach the problems of empirical reality by engaging with companies and that the study of *"transcendent"* phenomena should not monopolize the time of researchers.

The first group sees applied research as a distortion of the role of 'academic science' in which disinterest is necessary, while the latter thinks that science only moves forward with its application and only makes sense when generating economic and social returns. For the latter, the test in applied fields allows access to more robust responses, confrontation of theoretical models with empirical reality, finding errors in the theories formulated or new problems that require new solutions. These extreme views of science are in agreement with the proposal of Lam (2010). In the view of entrepreneurs, the role of science is *"to advance knowledge."* However, there are major questions about the behaviour of scientists. Entrepreneurs do not understand the reason why researchers have so much freedom at work. Many entrepreneurs pointed out that this flexibility generated no need to deliver results. In parallel, even those who were presenting results produced it in a form that was not understandable to laymen, usually as scientific articles. Entrepreneurs do not understand why researchers travel so much, why they go to conferences, seminars and workshops, why they give lessons at other universities and why they remain different lengths of time in R&D centres abroad. The 'academic science' is viewed with great suspicion, because it often "serves no purpose". They consider that research should be more focused on the problems that exist in firms' day-to-day life and the search to overcome these issues. Some entrepreneurs consider themselves the component that creates value in society, revealing a suspicion for members of the academy who are characterized with passive behaviour.

5.2.3. Profit, Times and Deadlines

Profit from research activities remains difficult to see for some members in the academy. Professors that engage in entrepreneurial projects, applied R&D and consulting remain easy targets of criticism from their peers. This criticism regards the provision of services, in which the analysis is oriented to the conclusions that the contracting entity wants to reach. Professors allocated to research can be accused of forgetting their teaching responsibilities and focusing on their "private" business. This was previously enhanced by the absence of reference frames in Portugal, something that begins to be limited with the creation of internal regulations for external services, IPR frameworks, and guidelines for the creation of spin-offs and start-ups.

Entrepreneurs have a focus on profit; however, it is too often focused on a short-term profit, limiting horizons and the dynamics of creating added value. A businesswoman quoted Milton Friedman ["The Social Responsibility of Business is to Increase its Profits" by Milton Friedman in The New York Times Magazine, September 13, 1970], stressing that corporate social responsibility is only about making profit, paying wages to workers and fulfilling commitments to suppliers. She was forgetting the role of the company to provide qualified employment and a sustainable economic growth at an aggregate level.

Another problem mentioned by entrepreneurs about researchers is that the response time is often considered too long. In parallel, researchers suggest that entrepreneurs who have an immediate interest, and who are much less concerned with the overall validation of the results of research, are focused on understanding and gradually permitting the building of economic advantages to be appropriated by the company. According to the information from the firms, in addition to the researchers' difficulties in meeting deadlines, the functioning of the public university presents itself with a very high amount of negative bureaucracy, which slows and threatens all collaborative processes.

5.2.4. Human Resources Training

The essential role of the university remains the training of human resources. This is a central channel for transferring knowledge because the inclusion of qualified personnel improves not only the competitiveness of the company but also its 'absorption capacity' of new knowledge. Furthermore, in the opinion of the participants, the fact that a company employs former students creates a proximity that induces additional contacts with the university. Many collaborative relationships are based on these previous, informal contacts.

However, participants on the business side stressed that the university does not train students for specific regional companies limiting their preparation for working life. The lack of students for the business fabric of the region remains high. The insertion of students is limited, despite being an essential mechanism for the increased absorption capacity in companies, restricting the existence of qualified people who can interact with advanced knowledge.

The university as a source of recruitment continues to fail, missing the connection paths with business. The creation of mechanisms to support student recruitment and entry into employment is important, emphasizing the relevance of professional internships, extinguished in practice with the implementation of the Bologna process. The link between employability and knowledge transfer mechanisms should be a target for additional attention.

5.2.5. Proposals for the Effectiveness of Knowledge Transfer

Overcoming these dimensions of tension requires some action such as the examples that the group suggested. University-firm relations need a more effective dissemination of the knowledge supply and existing technology and a deeper understanding of business needs.

Researchers should be encouraged to establish agreements and partnerships between the university, research centres and skills and the local business.

Within the university, it is crucial to set up offices or cells within each school and/or faculty to assess the knowledge developed and related business demand. This can be very useful for identifying companies' skills to stimulate the sophistication of their strategies, in particular innovative activities, thereby enhancing competitiveness. Regularly translating scientific research developed and published in specialty magazines for non-expert audiences is fundamental in order for knowledge to be detected by the entrepreneurial system and seized by citizens in general. The successful communication of science can have positive impacts on the absorption capacity of individuals and firms.

To promote the university as a source of recruitment, an emphasis should be placed on a technical component, which has been more sought by companies with greater connection to practice. Another aspect is to focus on a greater involvement of firms in education pathways, participation in training events, internships for students and re-structuring of curricula.

Unanimously, there is a required action for organizational strengthening within the university regarding the transfer of knowledge. It is very important to develop regulations and standards for creating relationships with start-ups and academic spin-offs, for the adaptation to the teaching service of these activities, for the new role of the university and for the protection, management and licensing of IPRs. In parallel, the autonomy and professionalism of knowledge transfer services must be guaranteed. According to the vision of the participants and with the support of the university, particularly in the financial aspect, the KTOs should be free of project perspectives, stabilizing and qualifying their staff to ensure higher decisional autonomy. Finally, the office should institutionalize its activities. This issue conditions all the success of the new role of the university in view of the participants.

6. CONCLUDING REMARKS

Knowledge transfer has had the attention of decision makers in stimulating regional development on different scales of intervention, from the regional operational programs to the European Policy. This article underlined that the transfer of knowledge deserves a closer look from other approaches, since it has been a theme highly explored by references imported from Economics or Management to Regional Science. The contributions from the social studies of S&T can be crucial to understand what goes on inside these 'black boxes' that we have come to see just like indicators and, increasingly, as goals: a created new product, a new technology-based company, a licensed patent, and a research project in collaboration. It is crucial to understand what happens until the transfer goes ahead. It is this attempt to realize the transfer process, the role of the actors and the structure of the networks that may be enriched by the contributions of the SSST to create more satisfactory knowledge about what conditions enhance a successful, university-firm relationship.

The discussion highlighted the contributions of Fleck in social studies of science and technology. His contributions allowed the understanding of the current context of the scientific world where the production, dissemination and transfer of knowledge encompasses a broad range of actors. These actors belong to distinct collectives of thought characterized by specific styles, as proved to be the case for individuals from academia and the business world. The transfer of knowledge requires a translation between these collectives that is neither easy nor free from lapses. The empirical analysis of the Algarve emphasizes the importance of 'marginal individuals' in the contact, migration and cross-fertilization of concepts between collectives of thought and reinforces the role that interface organizations assume as mediators in the process of knowledge transfer. Tensions illustrated with the styles

of thought of the firm and the university tend to be overcome with the emergence of hybrid actors, 'marginal' in the designing of Fleck, who can talk with the various groups.

Knowledge transfer offices, as mediators that focus both collectives, must contain elements in their staff who can understand different styles of thought, specifically the university and the firm, in order to facilitate an effective translation. Members of staff of these intermediate bodies require increasingly new types of entrepreneurial skills and a mix of business people from the academy with a new type of researcher. These individuals need to maintain a quasi-firm activity based on highly competitive R&D and should be more concerned with the issues of transfer while being able to translate their own interests.

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